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USAISEC

US Army Information System Engineering Command
Fort Huachuca, AZ 85613-5300

U.S. ARMY INSTITUTE FOR RESEARCH
IN MANAGEMENT INFORMATION,
COMMUNICATIONS, AND COMPUTER SCIENCES
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AD-A218 302

Configuration Management, Capacity Planning Decision Support, Modeling and Simulation

(ASQBG-A-89-036)

DECEMBER, 1988

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Atlanta, GA 30332-0800

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UNCLASSIFIED
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704--188
Exp. Date: Jun 30, 1986

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS NONE
2a. SECURITY CLASSIFICATION AUTHORITY N/A 2b. DECLASSIFICATION / DOUWNGRADING SCHEDULE N/A	3. DISTRIBUTION / AVAILABILITY OF REPORT N/A
4. PERFORMING ORGANIZATION REPORT NUMBER(S) ASQBG-A-89-036	5. MONITORING ORGANIZATION REPORT NUMBER(S) N/A
6a. NAME OF PERFORMING ORGANIZATION AIRMICS 6b. OFFICE SYMBOL (if applicable) ASQBG - A	7a. NAME OF MONITORING ORGANIZATION N/A
6c. ADDRESS (City, State, and ZIP Code) 115 O'Keefe Bldg., Georgia Institute of Technology Atlanta, GA 30332-0800	7b. ADDRESS (City, State, and Zip Code) N/A
8a. NAME OF FUNDING/SPONSORING ORGANIZATION AIRMICS 8b. OFFICE SYMBOL (if applicable) ASQBG - A	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER
8c. ADDRESS (City, State, and ZIP Code) 115 O'Keefe Bldg., Georgia Institute of Technology Atlanta, GA 30332-0800	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 62783A PROJECT NO. DY10 TASK NO. 07 WORK UNIT ACCESSION NO.

11. TITLE (Include Security Classification)

Configuration Management, Capacity Planning Decision Support, Modeling and Simulation (UNCLASSIFIED)

12. PERSONAL AUTHOR(S)

G.J. Dunleavy

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
	FROM ______ TO ______	1988 December	29

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	Information Management, Decision Support

19. ABSTRACT (Continue on reverse if necessary and identity by block number)

This report is targeted at articulating a methodology and model for Information Management of data relating to the configuration of the present, planned, and target Information Systems Resource. This report describes a high level module that characterizes the information flow through the Army community for a requirement generated by a user. Additionally, the use of Decision Support tools within ISC and ISEC is addressed.

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED / UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL Michael J. Evans	22b. TELEPHONE (Include Area Code) (404) 894-3107 22c OFFICE SYMBOL ASQBG - A

DD FORM 1473, 84 MAR — 83 APR edition may be used until exhausted. All other editions are obsolete

SECURITY CLASSIFICATION OF THIS PAGE
UNCLASSIFIED

This research was sponsored by the Army Institute for Research in Management Information, Communications, and Computer Sciences (AIRMICS), the RDTE organization of the U.S. Army Information Systems Engineering Command (USAISEC). This report is targeted at articulating a methodology and model for Information Management of data relating to the configuration of the present, planned, and target Information Systems Resource. This research report is not to be construed as an official Army position, unless so designated by other authorized documents. Material included herein is approved for public release, distribution unlimited. Not protected by copyright laws.

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s/ John R. Mitchell
John R. Mitchell
Director
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1. INTRODUCTION.

This task deliverable (TASK #2) is targeted at articulating a methodology and model for Information Management of data relating to the configuration of the present, planned, and target Information Systems Resource (ISR).

The foundation of the methodologies suggested in this task report are founded on three basic principals.

- Coordination and cooperation at all levels of the Information Systems Management process is both desirable and critical to the successful advancement of quality and quantity improvements of the services provided to the end-user community.

- Reporting systems developed for the management and audit of the operations, planning and engineering of the Information Mission Area (IMA) resources should employ the latest technology available to the managers and the automation process should result in more productivity at the action officer levels. The resultant productivity should be measurable and sustainable. The automation process should resolve repetitive reporting problems at the action officer level as opposed to creating new reporting requirements.

- The suggested methodologies must be implemented by the matrix personnel, and will utilize, and institutionalize to the maximum extent possible and practical, information available within the public domain and other Government agencies. Every attempt will be made to capitalize on work already done or in progress.

2. OVERVIEW.

The model and reporting schemes suggested in this report are not intended to be a detailed treatise on one particular technology, nor are they intended to produce a detailed implementation plan. The ISEC/AIRMICS element of ISC earlier this year produced a report titled "Guide for DSS Development". The methodologies in this report are both exhaustive and applicable to the task of developing a Decision Support Environment for a General Purpose Information Systems Management schema. The primary purpose of this report is to identify those resources presently available with which the ISC/ISEC community could evolve a

modern Decision Support System within a rapid time frame and with a modest expenditure of resources.

3. HIGH LEVEL MODEL FOR A DECISION SUPPORT UTILITY.

The model which is illustrated here as Figure 3.1 has been constructed to demonstrate the scope of the information flow requirements within the Army community. Figures 3.2 through 3.3 further illustrate a need for different data to flow in certain loops and via interfaces to both coordinating and controlling functions within the DA Staff, to other management agents within the Strategic and Sustaining Base communities as well as other DOD and non-DOD Information Systems Management Agents.

The premise of this model is that every action begins with a end-user driven requirement and ends with a product or service delivered to the end-user.

Existing Army regulations provide for a number of options for an end-user to satisfy his requirements within the resources available to himself and his MACOM. The model will not in any way attempt to detract from the end-users ability to satisfy his bottom-up driven requirements, but will capture the resource usage and scheduling information for inclusion in a Total Information Systems Status and Reporting System, a component of the All-Source Data Base.

There are essentially two types of requirements which must be accounted for in the control and resource allocation processes. The first is a bottom-up driven requirement which originates with a user and flows from the user to his DOIM, and proceeds through a loop consisting of the user, his DOIM, his MACOM and ISC. The second is a top-down driven requirement, with the need originating above the level of the MACOM. The bottom-up or a series of bottom-up requirements which could not be satisfied via MACOM controlled assets could result in the formulation of a program which might then become top-down driven.

Direction not withstanding, the users and planners are vying for some portion of a fixed asset resource which is common to all Information Systems users. A system level view of the ISR clearly demonstrates that the ISR is definable and traceable back to the ultimate finite resource which is budget dollars.

Budget dollars and the resources they provide, have always been less than the requirements. Every indication available points to further reductions in the budget allocations targeted to the ISR, and additional efforts must be expended

to improve the value received for each dollar spent.

ISC/ISEC are acutely aware of the need to maximize values not only in the acquisition but in the maintenance and operation of the systems. The Command and Control (C2) of the ISR is a data intensive operation. The value of the judgements made regarding the retention of a current asset, technology insertion or a new resource have an impact across the entire delivery system.

Modern Information Systems practices proffer a very extensive set of management aids to assist managers at all levels in identifying and prioritizing actions. The range of aids include widely used, off-the-shelf, spreadsheet and database programs to custom programs which also provide a range of capabilities. One example is the production of statistical information concerning performance of switching nodes, run times of applications in a mainframe queue and in some instances, requests for service statistics on multiplex facilities. The objective in using these aids is to maximize the value of all expenditures in the Information Systems arena. The sooner the C2 function of the ISR is operational the greater the value to the information systems community will be.

With that in mind, DSI has constructed a Quick-Fix method based upon maximizing the use of existing resources and technologies. The operative action is to interface and integrate existing data resources with analytical tools and to develop and disseminate the results and recommendations to the broadest segment of the information systems community. Properly implemented, this action will foster and institutionalize cooperation and communications at all levels.

The method DSI is considering is a bridge product between the ARPMIS database (or any other data base) and another database containing the analytical/modeling/simulation and decision support tools. One technique being considered to accomplish the merger is via the "C" Language "Fork Command".

The attachment to this White Paper represents a technology transfer request to Rome Air Development Center (RADC) which identifies multiple resources. The list of resources is representative, not exhaustive, at this point.

3.1. Introduction.

As the IMA reorganization proceeds to its full implementation, the DOIM and other action officer level personnel in the IMA arena are being tasked for ever greater achievements. Notwithstanding the future development of the Army Information Architecture and its four underlying

components, the information model, the data architecture, the applications architecture, and the geographic/technical architecture, the satisfaction of a user's needs and requirements in a timely and economical manner has not been directly addressed. In fact, providing the solution to a user's need which is identified today can easily take in excess of three years---if no major problems are encountered. Hardly a rapid response from any point of view.

When the acquisition process for hardware, software and particularly communications is examined several significant issues quickly come to the forefront. DSI experience has shown that top-down driven efforts are generally fielded faster than bottom-up efforts. This relatively rapid fielding can be attributed to high system/program visibility (normally of a political nature), strong support from the ARSTAFF, a concentration of effort, and adequate funds. The caveat is that the lead time on these top-down efforts generally fosters the creation of a solution which no longer accurately addresses the original problem. Witness the inability of SAILS to handle all of the facets of supply requisitioning at the installation level.

Bottoms-up efforts are characterized by manual or stubby pencil operations supplemented by few automation tools. Those tools which are in place are either batch oriented with very infrequent updates, quarterly in some cases, or which are not being utilized to their greatest potential. There is little that a user or even a DOIM can do to determine the status of say a Request for Service after it leaves the DOIM's office. For many users the only real status they see is when the vendor arrives on-site to install the circuit.

This WHITE PAPER proposes a model which will address an action officer level Decision Support System. The All-Source data base with an internal Decision Support System model proposed by DSI was conceived with the goal of being able to rapidly implement a solution to significant problems using reasonably economic technology.

3.2. Conceptual Operation of the Model.

A bottoms-up requirement is the most complicated and the most difficult to manage by ISC personnel. On the surface this seems a contradiction. The top-down driven systems are indeed very large, complex, and demand intensive management by large staffs in the PM and PEO offices. The matrix support is provided by ISC and it is becoming more extensive and expensive. Generally, adequate resources are available for these systems because of their high visibility. The bottom-up user driven requirement is almost insignificant in comparison. This lack of "importance" leads directly to a user requirement's low visibility and a low priority once in

the system. However, the ratio of top-down to bottom-up driven requirements is staggering.

The exact number of top-down systems/programs is difficult to accurately determine for several reasons. First, there is no single or clear cut definition of "top-down". Generally, one can say top-down systems originate at the ARSTAFF or equivalent level and are pushed down to the users. Second, there is no separate validation or approval process for top-down systems per se, and lastly, the approved/validated requirements list (IMP/IMMP data base) is not static. A baseline review with periodic follow ups of the validated requirements in the IMP/IMMP must therefore be the basis for determining the scope of the problem.

Bottom-up requirements also lack a precise definition but are clearly ones which originate at the user level down in units, be it MACOM, battation or Reserve center. Just as there are more users than there are ARSTAFFs, bottom-up requirements are more numerous than top-down requirements. Since the U.S. Army decided to authorize the decentralized procurement of small computers and their associated peripherials and software, users have been busy buying hardware and software in an attempt to automate their total work areas or just single job requirements. This approach is unorganized and does little to alert the ISC/ISEC community to the impact on support needed to sustain this growing automation base. The sheer volume of users requesting support makes this a prime area of management concern in this model. Especially, since ISC/ISEC have not been able to keep the pace with the level and sophistication of automation required to provide responsive support to the users.

Figure 3.1 demonstrates the general flow of information within the Army community. This flow includes both top-down and bottom-up requirements. The flow also includes hardware, software and transfer acquisition, installation, operation, management and upgrade as required.

Satisfaction of a users needs and requirements is a difficult and detailed process. The key assumptions at this point are that the need or requirement has already been properly identified and approved within the IMP/IMMP process and that the appropriate types of funds are available. If the following discussion covered hardware, software, and transfer it would be exceptionally long because of the numerous combinations and variations possible. Instead Figure 3.2 addresses more detailed information flow within the Information Systems Agents only as it relates to the acquisition of transfer capability/capacity otherwise known as communications.

After the user has gone through the IMP/IMMP process and has the funds available he can now begin the process to register

the proposed system in ARPMIS, the automated replacement for DARTS. Most users will have to go their local or installation DOIM and initiate the request to be registered in ARPMIS. After this registration is completed the user will then submit a request to the DOIM asking that the appropriate the communications capability be provided. If the DOIM can satisfy that need with a circuit that can be procured within his scope of authority such as a local business line then the DOIM takes the appropriate steps to complete the acquisition and satisfy the user's need.

If the required connectivity exceeds the DIOM's local procurement authority, the DIOM will generate a Request for Service (RFS) and forward it to the MACOM. The MACOM validates the RFS and sends it to the Army Commercial Circuits Office (ARCCO) at Fort Huachuca, AZ. If ARCCO can satisfy the requirement within its resources by using existing circuit capacity, if available, it will.

If the circuit requires the use of the Defense Data Network (DDN), ARCCO will generate a Telecommunications Service Request (TSR) and send it to the DDN office in Washington D.C. They approve or disapprove the request. If approved (they generally are), then a TSR is sent to the Defense Communications Agency Operations Center (DCAOC) at Scott AFB, IL.

DCAOC will attempt to satisfy the users requirement within its existing communications resources. If this is possible they send an order to the appropriate vendor(s) for action. If DCAOC can't satisfy the need with existing connectivity they will send a Telecommunications Service Order (TSO) to the Defense Commercial Circuits Office (DECCO).

DECCO utilizes a Request for Bid to get industry to bid on providing the necessary service. When a contract is signed DECCO sends a Completed Leasing Action Message (CLAM) to all previously involved parties notifying they of the expected installation date.

Eventually, one or more, maybe three or four different vendors will contact the local DOIM and user to arrange the details related to the circuit installation. After the circuit is "turned on" an In Effect Report is submitted. The purpose of this report is to notify all concerned parties that the government has assumed responsibility for the payment of the service provided.

As Bill-Back or Charge-Back comes on-line the user will be required to pay for the service he is using Until that time, either the Army, ARCCO or the MACOM will pay for the service.

Figure 3.3 introduces the model which DSI is proposing will

address the problems discussed above as well as other problems specifically related to acquisition of communication connectivity which will be discussed in following paragraphs.

The user's needs and requirements are the sole reason for the existence of the ISC community. It is we who must change to meet the users expectations and not the users to meet our expectations. Most of the time, a users requirements enter the system after they are brought to the DOIM. If the DOIM can't satisfy the requirement he will submit a RFS to the MACOM for validation. After this message leaves the DOIM's office the DOIM has lost the ability to quickly and accurately track the status of that RFS. Additionally, the DOIM has lost the ability to influence the decision to be made about the quality and quantity of the service to be provided to the user. Further, if any of the succeeding levels of command forget to include the originating DOIM as an INFO addressee on message traffic then the DOIM is even more in the dark than before. All of the above problems are common occurrences.

Two issues begin to surface at this point. One is the extremely long lead time ISC and DCA mandate on circuit acquisition. The published lead times, as long as they are, are mostly optimistic. The other problem is that within ISC the RFSs and TSRs are paper records. They begin as a written request from the user. The DOIM converts it to written, formatted message and put into the AUTODIN system to be transmitted to the MACOM. The MACOM receives the paper copy of the message from the message center, validates it, re-keys it into another written, formatted message and puts it back into the AUTODIN system to be sent to ARCCO. ARCCO essentially recreates this same process for messages bound for DCA. They follow a similar process generating AUTODIN messages which include all parties as either the ACTION addressee or and INFO addressee. The format and the information found in the message traffic at all levels above the user is basically the same.

The procurement of a normal DDN circuit, with no changes, delays or modifications will generate seven or eight separate pieces of paper at the user and DOIM levels. The total time consumed in this effort approaches two years.

By implementation of DSS at the action officer level within this circuit procurement cycle dramatic improvements can be achieved at minimum cost. The improvements can be achieved by eliminating the need to repeatedly hand-generate standard formatted messages which are then sent via AUTODIN to all addressees and then reduced back to paper again. Administrative time is reduced and circuit procurement time is shortened. Additionally, suspenses and status can be determined quickly and corrective action applied on the spot. The time savings

achievable need further research. Total resources saved or costs avoided will be directly related and impacted by how thoroughly this proposed change is implemented within the ISC/ISEC community.

The primary advantage of ARPMIS has been to automate the Data Requirements Transfer System (DARTS) process. The DARTS registration process was a manual system and it added at least six months to the already lengthy circuit acquisition process. The use of DARTS before one could request a circuit was absolutely mandatory. If your equipment was not registered in DARTS you would never be allowed to request a DDN circuit.

ARPMIS is hosted on a computer in the Pentagon and each DOIM has a terminal which provides access to the database. This allows rapid equipment registration but does little to accelerate the RFS process.

3.3. Responsibilities/Suspenses.

The suggested combination of an All Source Configuration Data Base, Decision Support Utilities and Program Management Support Systems at all levels provides an opportunity to more closely monitor responsibility and to reduce the suspense cycles.

Program Management Support System development is underway with the PEO's, PM's and ISC/ISEC. Top Down requirements will be captured and documented in the respective Program Management Systems. A similar type utility at the DOIM level which is compatible with the top-down driven programs would complete the cycle for capture of resources, funding and schedules pertaining to a specific program or program action in any of the IMA areas.

Once again a Decision Support Utility with cooperative processing attributes could serve as the broadcast agent for actions, suspense and suspense closings. Time lines could be assigned for completion of each action and every action or supporting element would be keyed to the same set of actions. This would also create an action item audit trail at each of the action levels as well as in the All-Source Data Base.

3.4. Bill Back/Charge Back.

Users invest a great deal of time and effort in seeking the solution for their needs and requirements. One of the major concerns of the user and actually of all members of the government is to avoid wasting tax dollars. Any solution which ignores this basic responsibility is not in our best interest. This doesn't mean that the cheapest solution is

always the least expensive solution. Our efforts must be directed to the most cost effective solutions.

The Army has developed various methods for the procurement of different parts of information systems. Information systems include hardware, software and transfer. The acquisition, distribution and support of hardware is a well developed methodology and is relatively efficient. Software acquisition or development, distribution and support represents an order of magnitude of more difficulty. Costs are high and difficult to control compared to hardware. Development time as opposed to simple acquisition continues to take longer and longer. While costs are high they are easy to identify and charge back as appropriate. Some relief is on the way as new tools become available. Transfer acquisition and support costs continue to escalate with no relief in sight.

Without Bill Back/Charge Back, users are not being fairly treated. Some are bill payers for others without even knowing it. ISC is attempting to implement this type of structure but results won't be seen for years. Once implemented it will be part of an integrated system that the DOIM and other action officers can effectively utilize? Will it be another "stove-pipe", batch oriented type of operation?

Bill Back/Charge Back must be an integral part of ARPMIS. Through the action officer DSS it could become an integrated part of a Total Information Systems Status and Reporting System. The end result of this effort is improved management and cost reduction. The engineering agency should receive some of the benefits from these improved efficiencies. DSI suggests a split between the user and the engineering agency on all savings realized through this program. The funds returned to the engineering agency would go into a reinvestment program to achieve further savings. A benefit which then would be achievable is the establishment of a better basis for funding. Both the requests for future funding and for the utilization of existing funding would be improved.

4. Decision Support Tool Requirements.

The need for decision support tools fall into three categories.

4.1. Systems Configuration Data.

The analysis of present systems in order to ascertain their current configuration data will require examining at least

the following items.

MIS/DP Systems
- o Hardware
  - o CPU
  - o Peripheral Sets (Tape/Disk/Printers/Scanners/I/O Controllers etc)
- o Software
  - o Operating System(s)
  - o Utilities
  - o Applications

Communications Systems
- o Local (includes LAN connections)
- o Wide Area
- o Long Haul

4.2. Modeling and Simulation Aids

The components of an information system exhibit varying capacities to "do-work". The measurement which is meaningful is a unit's or element's ability to do work in the configuration it is employed and with its relationship to other elements of the system.

One facet of the system design process involves the measurement of a system's ability to do-work under a predetermined set of circumstances. The predetermined set of circumstances can be varied by mixing the types, quantity and quality of do-work operations at one or more points in the cooperative, do-work environment. Classically benchmark measurements are used for this purpose and they provide a one-for-one measure of a static state and of introduced variable. The variable could be the comparison of two models of the same unit or a measure of a unit to perform work under varying systems conditions. A conditional change might be a reduction in I/O throughput arising from communication line failure(s), a change in the mix of applications in the processor queue or any other circumstance dealing with scheduling or the health and welfare of the system.

4.3. Capacity Measurement and Capacity Planning.

Element and system level capacity measures can and should be made. The measures should be appended to the Configuration Management Data Base and interfaced to an analytical tool set which will enable the Information Systems Manager to calculate performance, excess capacity or means to increase capacity to meet emerging capacity needs.

5. INFORMATION SYSTEMS ENVIRONMENT.

The Information Systems Environment is one of great complexity. The multiplicity of ways to view of the environment does nothing to help simplify the problem. One could describe it by looking at hardware, or at software, or at communications, or by its functionality, or by its users, or by the architecture employed, and so on ad infinitum.

The information and discussions that follow are general in nature and are limited to three specific areas: a review of present DSSs in ISC/ISEC; identification of Information System Resources available within ISC/ISEC; and identification of Information System Resources required by ISC/ISEC. The identification of these resources is directly related to technology transfer and the need for better ways of doing business.

5.1. Present Decision Support Systems in ISC/ISEC.

Decision Support Systems (DSS) are emerging at the Mainframe, Work Station, and PC levels.

The Decision Support System running on the ISC Pentagon System serves the United States Army Decision System Management Agency (USA DSMA) which was organized in the late 1970's as The FORECAST Project Management Office. A series of analytical models were developed for the Army Personnel Management community to provide capability to project the strength of the Army components, and to simulate the interactions of gains, losses, promotions, and reclassifications to determine the impact on policy changes on the desired objective force.

In October 1986, The Vice Chief of Staff, Army (VCSA), directed the establishment of the USA DSMA as an outgrowth of the original FORECAST Project Office. In addition, he directed the establishment of a Decision Support Management Office (DSMO) in each of the ARSTAFF agencies. The DSMO's are the agency functional proponents for development of Decision Support Systems (DSS) to support their agency requirements, while USA DSMA serves as the overall coordinator, facilitator, and integrator of the various agency development efforts.
USA DSMA has a DSS Master Plan which is considered to be an evolving document.

The Master Plan includes listings of current users, and plans to add additional users.

DSI reviewed USA DSMA's current RFP for "Technical Services to Achieve Total Systems Integration for the U.S. Army

Decision System Management Agency (USA DSMA)". The RFP was issued as a Small Business Set aside. Solicitation Number MDA9093-88-R-104 was issued in August of 88 and had a closing date of 6 Sept. 88.

If one were to consider the work description in the reference RFP and it's interfaces to other systems the potential number of subscribers is more than 3,000. There are currently 3000 PROFS users on the Mainframe System.

Generally a mainframe should not be considered as a good environment for a Decision Support Utility. Questions will and should arise relative to the functionality and usability of DSS operation in a Mainframe environment. The DSMA Project is currently running in contention with other processes on the Pentagon Mainframe. The DSS tasks and the nature of the processes associated with the highly iterative AI based operations are not ideally suited to a mixed application environment.

The nature of resource management and operating systems (OS) restrictions place severe limitations on the performance of Expert Systems Shells in the mainframe environment.

The DSS development at the DA STAFF level is not at this juncture time-sensitive, and it is not probable, that the time lines could be much improved in the near term.

DSSs serving time sensitive operations such as maneuver control, dynamic circuit allocation and post attack reconstitution are not good candidates for mainframe level support.

Workstations, PCs and Parallel Processing Machines with extended memory capabilities, and rapid access to DASD peripherals constitute the best development and implementation environment at this time.

DSSs have been successfully developed as Medical Diagnostic and in the Air Force Tactical mission planning areas. There are many candidate areas for DSS in the ISC/ISEC service area. A list of Potential Candidate DSS within ISC/ISEC are:

- Productivity in the Software Development Area.
- Bill of Material Preparation Keyed to Equipment Lists.
- Capacity Planning at Major Processing Centers
- Technology Insertion Planning
- Network Planning
- Trade-offs Cost vs. Performance
- Routing Optimization
- Queue Optimization
- Disk Interleaving
- Automated Maintenance Assistants
- Dynamic Reconfiguration in Large Networks

- o Navigational agents in Large Data Bases and Communications Networks.
- o Pre RFP Release Market Surveys

Potential users of DSS tend to mistrust the power of the machine, and to view the entire Artificial Intelligence, Expert System, Decision Support movement as being anti-human.

In time, DSS will become transparent to the user and will be embedded in many of the man-machine interfaces. Products of this type are what we should deliver to the managers and action officer level of ISC/ISEC.

5.2. Available Information System Resources.

The following is a general overview of the available DSS Mainframe Hardware and Software Configurations.

HQDADSS System Configuration Summary for Hardware:

CPU: IBM 3081 Model K64
- -- 18.3 MIPS
- -- 64MB Core Storage
- -- Two Processors, running as one under control of CP.
- -- 16 Channels on-line, another 8 being produced to allow for channel speed connect of distributed processors.

TAPE:
- -- Four 3420 tape drives on-line, controlled by 3203 control unit.
- -- 3480 cassette style drives in architectural plans. Both must coexist in order to have full interface with other systems.

DISK:
- -- Three 3880's controlling 6 channels of DASD. Upgrade to cache 3990's in configuration stages.
- -- 24 3880 Dual Density DASD, (Model E 56B each), totalling 120GB.

CHANNELS:
- -- 6 - DASD
- -- 1 - TAPE
- -- 2 - TELECOM (1 per FEP)
- -- 7 - LOCAL COMM CONTROLLERS (5 each 32-port 3274 D41 per channel)

Communications:
- -- Two 3725 Model 1 Front End Processors.
- -- Each 3725 w/ 64 low speed ports (up to 9.6) and 8 high speed ports (up to 56KB)
- -- Each with 2 channel adaptors.

- -- 85 dedicated communications lines (mostly 9.6) serving 3274 model C61 or C41 control units running SDLC
- -- 6 dedicated communications lines (4.8) serving host attached 6670 laser printers running BSC
- -- 9 dedicated communications lines (9.6 - 56KB) connecting HQDADSS host to 5 other hosts running SDLC
- -- 30 - 3274 cluster controllers connected to ISC-P host using SNA connect to gain access to HQDADSS
- -- 24 - D41 model 3274 controllers carrying 88 3299 multiplexers (8 ports each) running BSC
- -- 1 PARADYNE network connect box carrying 32 ports for USAFAC users to connect (unidirectional) into HQDADSS.
- -- 1 7171 ASCII Protocol Converter with 64 ports for dialup and ASCII/ASYNC terminal interface (HIOS)

USER LOAD:

- -- 3500 PROFS user IDs
- -- Avg 550 - 600 simultaneous logons during standard workday
- -- 65 disconnected service machines (SQL, ADA, PROFS)
- -- Aggregate CPU % bisu avg 96/
- -- Steal/load seldom over 0.

HQDADSS System Configuration Summary for Software:

PROD NAME	REL	VENDOR
VM/SP	5	IBM
HPO REL	5	IBM
ASSEMBLER H	1	IBM
CMS	1	IBM
CMS SORT	1	IBM
PASSTHRU	3	IBM
PVM/3101	1	IBM
VIRTUAL SPOOL RDR	1	IBM
VMMAP	1	IBM
SMART	2	IBM
IPCS	4	IBM
DSF	8	IBM
DIRMAINT	2	IBM
IPF	1	IBM
HOST FILE TRF	1	IBM
VFORCE	2	IBM
ESE/VM	1.0	IBM
INFORMATION MGT	1.0	IBM
QUERY MANAGEMENT FAC	2.0	IBM
DXT	2.0	IBM
CROSS SYSTEM PRODUCT	1.1	IBM
INFO/SYS	1.1	IBM
VIRTUAL STORAGE EXTE	3.0	IBM
STRUCTURED QUERY LAN	3.5	IBM

STORAGE AND INFORMAT	1.1	IBM
SQL/EDIT	1.1	IBM
SCREEN DEF FAC II	1.1	IBM
SQL/REPORT	1.0	VM SOFTWARE
CUSTOM FORMAT OPTON	303D	AI
PGF GRAPHICS INTERFA	303D	AI
INTELLECT VM-SQL/AS	303D	AI
INTELLECT/SX	303D	AI
INTELLECT DBMS INTER.	303D	AI
KBMS	8802	AI
SYSTEMWW	8	COMSHARE
INQUIRE	86.1	INFODATA
EASYTRIEVE	3.0C	PANSOPHIC
EZ/SQL	3.0C	PANSOPHIC
EZ/KEY	3.0F	PANSOPHIC
EZ/KEY	3.1	PANSOPHIC
VMLIB	3.1A	PANSOPHIC
VM PREDICT	2.2	SOFTWARE AG
ADABAS/NATURAL	1.2	SOFTWARE AG
ADABAS/VM OPTION	0.0	SOFTWARE AG
ADABAS	1.8	SOFTWARE AG
SYNCSORT CMS	6.1C	SYNCSORT
MPSIII	2.0	KETRON
SYBACK	2.0F	SYNCSORT
VMBACKUP	4.1	VM SOFTWARE
VMSPOOL	1.0	VM SOFTWARE
ACF2	3.1	COMP ASSOC
SAS/BASIC	5.16	SASINST
SAS/AF	5.16	SASINST
SAS/GRAPH	5.16	SASINST
SAS/ETS	5.16	SASINST
RSCS	2.2	IBM
HDDI	2.0	IBM
DW370	1.0	IBM
GDDM	2.2	IBM
ACF/VTAM FOR VM	3.1.1	IBM
NCP VER 3	3	IBM
EP	3	IBM
SSP VER	3	IBM
NTO REL	2.1	IBM
NETVIEW	1/2	IBM
TCPIP	1.0	IBM
SERIES/1 EDX PROG	5.2	IBM
SERIES/1 EDX BASE	5.2	IBM
COBOL COMP & LIB	3	IBM
COBOL INTER DEBUG	3	IBM
FORTRAN COM/LIB (VS)	3	IBM
FORTRAN "G" COMP	3	IBM
FORTRAN COMP & LIB	3	IBM
PL/1 OPT	4	IBM
PL/1 TRANS LIB	4	IBM
DMS	?	IBM
ISPF/DM	1	IBM
ISPF	2	IBM

ISPF/PDF	1	IBM
ISPF/PDF	2	IBM
PROFS	2.2	IBM
WANG/PROFS GATEWAY	2.0	WANG
DCF	3	IBM
(6670 PRE/POST)	2	IBM
BUSINESS BASIC	1	IBM
STAT BASIC	1	IBM
MATH BASIC	1	IBM
MPSX	1	IBM
OMNICALC	5.3	TOWER

Work Station, LISP Machines, and PC level development environments.

LISP Machines, AI Inference Engines and the class of high end AI dedicated machines are generally too expensive. Lisp and Prolog, the dominant AI/ES languages require specialized technical skills unique to the Knowledge Engineering areas and missing from the standard MIS type programmers environment.

A representative list of single user Pc Shells includes:

1. NEXPERT/OBJECT COST $5,000

   Neuron Data
   444 High Street
   Palo Alto, CA 94301
   415-321-4488

*** Runs under MS-DOS, UNIX and Macintosh OS**

+---+
+---+

2. M.1 and Copernicus Cost range from $5,000 to $ 30,000

   Technology Inc.
   1850 Embarcadero Rd.
   Palo Alto, CA 94303
   415-424-9955

*** Runs under MS-DOS and MVS plus runs under OS on Sun & Apollo workstations.**

----

3. Rule Master 2 & Rule Master PCX cost between $495 & $1895

   Radian Corporation
   8501 Mo-Pac Blvd.
   Austin, TX 75380

*** Runs under MS-DOS, UNIX, XENIX and MVS**

+---+
+---+
4. **GURU** cost $6,500 for Single user $17,000 for LAN Version

Micro Data Base Systems Inc.
P.O. Box 248
Lafayette, IN 47902
317-463-2581

*** Runs under MS-DOS, OS/2, UNIX, and MVS**
+---+
+---+
5. **XSYS** costs $395 and up depending upon cpu

EXSYS Inc.
P.O. Box 11247
Albuquerque, NM 87192
505-256-8356

*** Runs under MS-DOS, UNIX , MVS.**
+---+
+---+
6. **CxPert** $395 for Object code $2,000-$4,000 for Source code

Software Plus
1652 Albemarle Dr.
Crofton, MD 21114
301-261-0264

*** Object Code runs under MS-DOS**
*** Source Code is written in C and can compile on any machine**
+---+
+---+
7. **COSMIC CLIPS** costs $250

University of Georgia
582 E. Broad St.
Athens, GA 30602
404-542-3265

*** Machine Independent runs Under C compiler**
**** Originally developed by NASA. May be a candidate for a Technology Transfer to Government agencies.**

Development of these skills on this class of machine should, for the present, remain in the R&D lab.

Many shells and off-the-shelf products are available for the single user PCs running both DOS and UNIX. Multi-user versions are less available but becoming more common each month.

The types of DSS utilities with immediate to near term application can be developed and fielded on standard Army

hardware including:

- Zenith-248
- Sperry 5000
- DEC VAX Series
- Sun WorkStations
- IBM PC and PS/2 family and compatibles
- Apple II Series and MacIntosh
- AT&T 6300 Series

5.3. Required Information System Resources.

The proper employment of data base software and DSS tools are the key requirements for the next step in the evolutionary process of technology insertion and transfer. What data bases are the best candidates for upgrading? A configuration data base like ARPMIS. What should be in this Configuration Management Data Base?

First, the data is to reside in ARPMIS. As greater amounts of data are amassed, the resulting data base could be known as the All-Source Data Base.

Then the first candidate application should be the transfer of intelligent information and options, concerning the present state of the Information Systems Resource, and an overlay of in-process, and planned change.

The present, in-process and planned status of the information systems should be captured in electronic form in a centrally controlled and managed data base.

Information about Status and Status Reporting.

- o Planned Information Systems
  - o Proponent
  - o Matrix support being provided
  - o Description of System
  - o Projected hardware, software, and transfer requirements
  - o Initial Operating Date
  - o Full Operation Date
  - o Operational life time (life cycle)
  - o Suspense system to tract milestone actions

- o In-progress Information Systems
  - o Proponent
  - o Matrix support being provided
  - o Description of System
  - o Status of acquisition efforts, HW and SW
  - o Status of communications/connectivity acquisition.

- Present Information Systems
  - Description of System
  - Hardware, software and transfer information should be extracted from data elements listed above in HW and SW
  - Current communications cost by circuit
  - Funding levels

- Acquisition of connectivity for bottom-up requirements
  - Notification from Contracting offices and PM shops on the purchase of computers and the ship to addresses of users
  - Complete listing of all data elements needed for use in the prescribed formats.
  - Listing of action and information addressees
  - Suspense system to track action.
  - Signatory checks to determine who is working or has completed the action.
  - Billing information after connectivity has been installed and accepted.

Information about the hardware (Communications /DP/MIS/ANCILLARY).

- Hardware item identification (nomenclature)
- Top level serial numbers
- Subassembly serial numbers
- EC levels of top unit and subassemblies
- Stock number identification of all documentation relating to the unit of equipment
- Stock number identification of installation drawing package(s)
- Identification of Organization responsible for equipment support
- List of all Engineering Change Orders applicable to this unit type
- EC status of each item of equipment within the ISC/ISEC inventory.
- Description of how the unit is used as it is configured in the ISC/ISEC application
- Expansion capacity of unit beyond its configured state
- Description of O&M personnel skills
- MTBF/MTTR performance history-performance history should be measured against manufacturer's specified MTBF/MTTR's
- Identify any special tools & test equipment requirements
- Identify common tools and test equipment requirements
- Identify spare parts lists and source information

- o Identify units environmental requirements and limitations (TM/REFERENCE is adequate) TM#, PAGE, PARAGRAPH
- o Identify all software required to function as configured
- o Identify additional software which will run on this unit
- o Identify all ancillary and interface units
- o List Preventative or Margin Checking Maintenance routines and the performance frequency of each
- o Budgetary unit cost & support figures

Information about the Software.

- o Functional description of each unit of each package
- o Functional description of each unit of code in the package
- o Stock # identifier for each package
- o Stock # identifier for each unit of code
- o Source origin ID number
  - o COMMERCIAL ID#
  - o SDC"X" ID#
  - o Other ID# (AF, NAVY, DCA, DARPA, ETC.
- o Source ID# for product maintenance and development
- o Source IDs for coding team if government developed package (audit back to SDC development team)
- o Each development center should maintain a product development history for each software product. The history should include a productivity audit for each contributor. The measure being "good lines" of code per day."
- o Product development language
- o Lines of code per product
- o Memory requirement for each target environment for this product
- o Product reusability measurement
- o Development history of each product
  - o Cost/schedule estimate
  - o Cost/schedule performance
  - o Change and updates
    - o Reason for change or update
    - o Cost/schedule of each change or rerelease
  - o System performance goals
  - o Actual system performance measurements
  - o Product Quality measurement
  - o IV&V records
  - o Fielding schedules
  - o Beta test verification
  - o Product portability
  - o Product interface requirements

Information about the Transfer Utility(s).

  - o DDN

- DSN
- PROFS
- Common Data Carriers
- Connectivity
    - Dedicated
    - Dial up
    - Remote
    - Speed

Quite a number of the attributes shown for the ARPMIS/All-Source Data Base deal with performance and post installation performance. Measurements such as MTBF/MTTR are included to demonstrate the potential utility of the All-Source Data Base. This data can and should be used by the Plans and Program elements to verify vendor performance, by the O&M functions to track performance trends and by the DOIM to schedule inspections and to identify training needs and deficiencies. Data dealing with personnel performance i.e., lines of good code per day is the type of measurement. Extending the data beyond the source of origin is not micro management, but rather a quality check on system performance.

The combined All-Source Data Base and Decision Support tools could and should be extended to include the interface at EAC to the tactical world. A complete merger of Strategic/Sustaining Base and Tactical is possible and desirable. This merger could occur in a evolutionary fashion provided both sides of the EAC interface follow the same rules, data structure, etc.

Information about scheduling, resources management, and reporting should originate in an off-the-shelf Program Management System which is common to ISC/ISEC/PEO/PM and DOIM. The level of effort on this task does not permit a detailed review of each of the program management packages in use in the Army. Personal experience of the authors over the past several years shows that there is no single Program Management Support System (PMSS) in use, nor is there a consensus among those planning on deploying PMSS in the near term.

There is a general consensus that the data base products in the PMSS as well as other data bases should have an SQL feature. A persistent problem is the many different implementations of SQL. Far too often the burden of learning a new set of query commands is overlooked by the designers. This is an undue burden on the working level and should be eliminated. ISC/ISEC has made some strides in this direction with the selection of XDB as the standard for Data Base on development products.

Government can not influence the form and function of off-the-shelf products such as PMSS with broad commercial application. A standard product should be selected, if for no

other reason than to obviate the need for operational personnel to learn multiple implementations of Query Languages.

The Decision Support Utility can access the PMSS elements and extract resource data for inclusion in analysis and what-if decision cycles. The data merge for information residing in the All-Source Data Base, Program Management Support Systems, STAMIS (i.e., SIDPERS, ACPERS, STANFINS) and the Decision Support System can be managed by the DSS.

How should and could the information in the Configuration Management Data Base be used to assist the Managers and Action Officers in performing their respective duties? Clearly the action-officers, and more specifically the DOIM's should expect the DSS utilities to assist him/her in the automation of the routine and non-routine reports and updates.

The terminal devices used by the DOIM's, engineers, analysts, programmers, et al, should support linkage of their work performance with the All-Source Data Base, STAMIS and ISMs and provide the same level of service as described in the paragraph above.

To the maximum extent possible and practical those portions of the All Source Data Base which are unique to a specific installation or location should be resident at the user terminal as should the processes and aids needed to evaluate, proposed changes. Changes which are implemented at the DOIM or MACOM levels could then be uploaded to the All-Source data base.

Distribution of changes and updates to other data bases should be done via a cooperative processing aid embedded in the source data base update module. This action should be transparent to the end-user. The same DSS utility should be used to update PMSS data base as the result of actions requested by DOIM i.e., addition of DASD capacity, new circuit assignment, etc.

6. CONCLUSIONS.

ISC/ISEC has a long way to go to achieve the level of efficiency and effectiveness that is needed in all levels of the Information System Resource being used by the Army.

DSSs are the tools which offer improvement and rapid evolution through modernization. There are no Decision Support tools in the ISC/ISEC inventory which can be readily

applied to the problems surfaced in this paper.

DSIs interest has therefore been restricted to only select areas where significant problems exist and a corresponding potential for improvement is apparent. Those areas where the application of the right technology at the right place and at the right time will yield the highest payoff for the smallest expenditure.

ARPMIS is the key with which ISC/ISEC can reach higher levels of performance while expending fewer resources. ARPMIS and the data in it are inadequate to meet the current needs. To move toward a more responsive and useful system ARPMIS must be built up and interfaced with DSSs, including PMSSs. The purpose being to create and support the All-Source Data Base. The All-Source Data Base will provide the DOIM and those at the action officer level with a tool which will allow they to become more effective and efficient while providing the user with better service which is the ultimate mission of ISC..

A technique which can be used to help solve these problems is to establish a formal technology transfer system, both internally within ISC and externally with other government agencies and public sector sources. Technology extracted from this system can be applied against the ARPMIS problem as the first priority and to other areas as resources are made available.

7. RECOMMENDATIONS.

FIRST:

Establish AIRMICS as the formal "Technology Review and Transfer Agent" for ISC/ISEC.

An "All-Source" Technology Data Base should be developed and maintained by AIRMICS. The source data from the various inputs should be merged under major topic areas. Each entry should include capsule information on the program objective, sponsoring organization and points of contact.

The "All-Source" Technology Data Base will provide the ISC/ISEC planning, engineering and software developers with a total view of technical developments and assist them in extracting candidate technologies in a technology insertion program as well as assisting the engineers and developers in specification preparation, building candidate bidders lists, etc.

The AIRMICS connection to the NTIS/DTIS data base should be utilized by the elements of ISC/ISEC and the

subcommands. DSI has not been able to ascertain that other elements have current access to the DTIS data base. A statutory requirement exist for Market Surveys prior to initiating any new project. A survey of the DTIC Data Base should be a given so as to avoid duplication of effort or paying for the same efforts more than once. Assigning this portion of the Market Survey requirement to AIRMICS will insure (a) AIRMICS involvement in the projects at an early stage (b) a high degree of probability that the search and market survey was performed and included the vast technical data base at DTIC.

SECOND:

AIRMICS should establish a formal technology transfer program with all DOD R&D facilities who are engaged in R&D in any of the Information Systems areas.

DSI suggests that the technology transfer program between AIRMICS and the Air Force Rome Air Development Center (RADC) could be used as a model to formalize the exchange of technical data with the other DoD components.

THIRD:

Data obtained via the technology transfer program should be captured in electronic form and made available to all elements of the Army as a service of the AIRMICS activity.

A very preliminary estimate of the resources required to develop, install and activate the suggested data base system follows:

o Hardware	\$100,000.00
o Off-The-Shelf Software	\$ 50,000.00
o Labor to build data base, custom drivers and interfaces	\$250,000.00
o O&M Cost per year	\$100,000.00

The cost of the system would be offset by saving in cost avoidance alone within the first year. DSI tracks activity in the Commerce Business Daily. We have identified requests for RFP's from Army Elements which clearly are duplications of efforts underway within ISC/ISEC. One such duplication originated in 4th Army. The RFP was asking for bids on a major modification to an existing program called Computerized Area Maintenance Program (CAMSAMP). The program has identical functions of one of the Ft. Sill ISMs. This program or one of the Sill ISMs is a replication of effort. Avoiding one or the other will save the Army hundreds of thousands of dollars in development, fielding and maintenance costs. A judicious **market survey** could have identified the relationship between

CAMSAMP and the ISMs.

The system as conceived by DSI would be PC based. The peripheral set would include a suite of storage devices which would include fixed and removable hard disk, 3.5 & 51/4 inch FDDs with all density recording available, 9 track and 1/4 inch tape. The information in the various databases from which we would propose to extract and merge is in every form from paper reports to 9 track tape. The system would include provisions for page and hand scanning and the scanners selected would accommodate edit of the scanned images. The delivery system would be designed as a BBS with a SYSOP assigned to assist and provide data in the appropriate forms. The system would have download and upload capability.

Flexibility and expansion are the driving considerations at this point. DSI is confident that a baseline system can be designed and fielded in less than a year. The system would provide the information System community with not only technology based information but information about the activity in the information systems procurement area (Key CBD announcements to Key Words in the Information Systems Development Process).

Other sources of emerging and on-going R&D within the government (DOD and Non-DOD agencies) should be collected and merged with like data from the Small Business Innovative Research Program (SBIR) and the IR&D programs of the Information Systems Industry. Access to the IR&D programs should be a part of the technology transfer process between AIRMICS and the other government agencies

Use of Commercial Service On-Line forums to support technical personnel currency and a hands-on training tool. Several User Bulletin Boards offer special forums for engineers and software professionals.

- o NSA has a bulletin board with FORUMS for USER GROUPS and developers.
- o COMPUSERVE has a number of specialized FORUMS dealing with AI and Expert Systems. The ISC/ISEC engineers and software developers could benefit from participation in this type of FORUM.

FOURTH:

Implement action to upgrade ARPMIS.

By the judicious use of information being developed under this contract with DSI and additional information to be extracted later from the All-Source Technology Data Base recommmended above, ARPMIS should be upgraded to provide the

services described earlier.

INFORMATION FLOW OF REQUIREMENTS

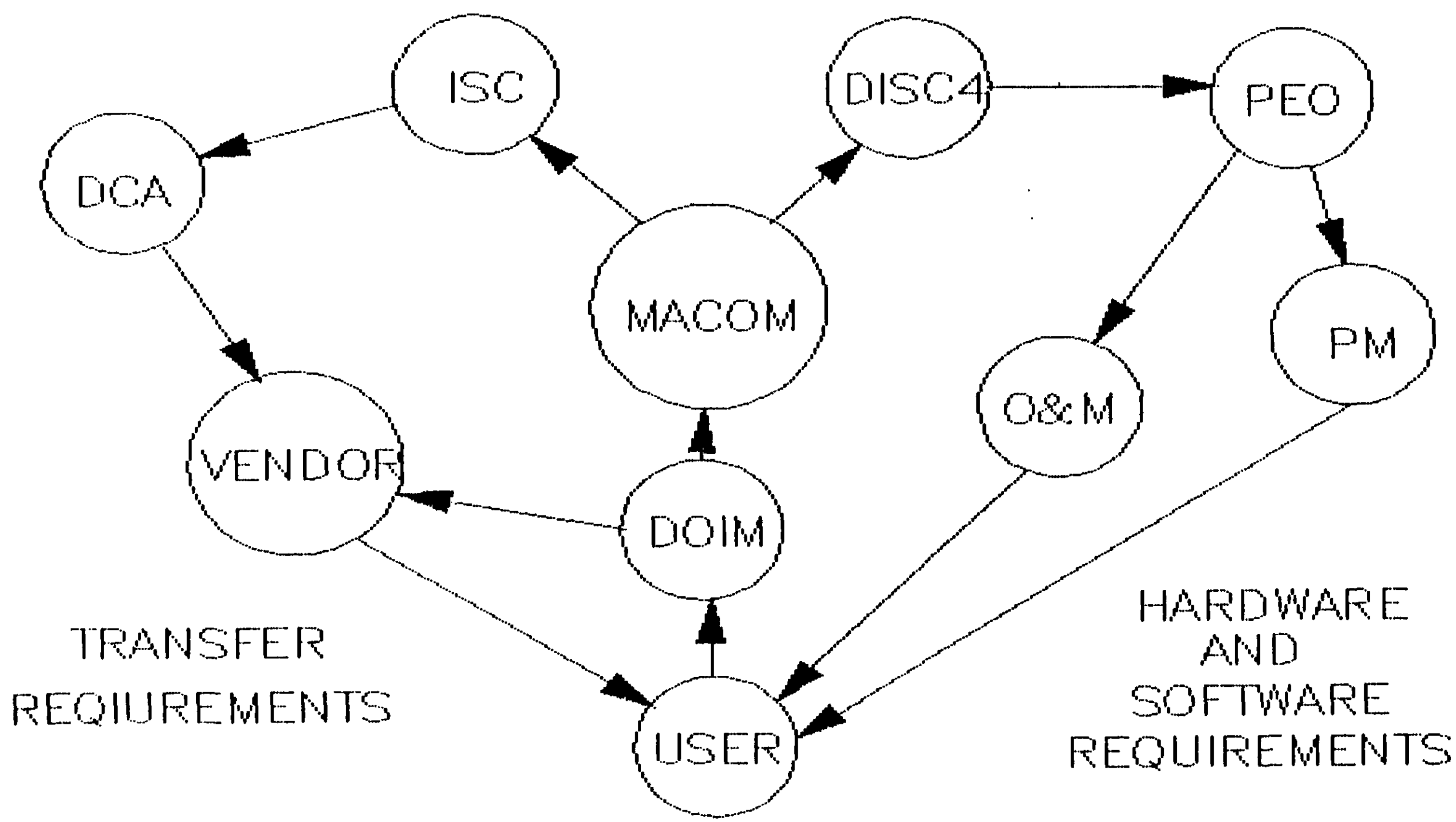


FIGURE 3.1

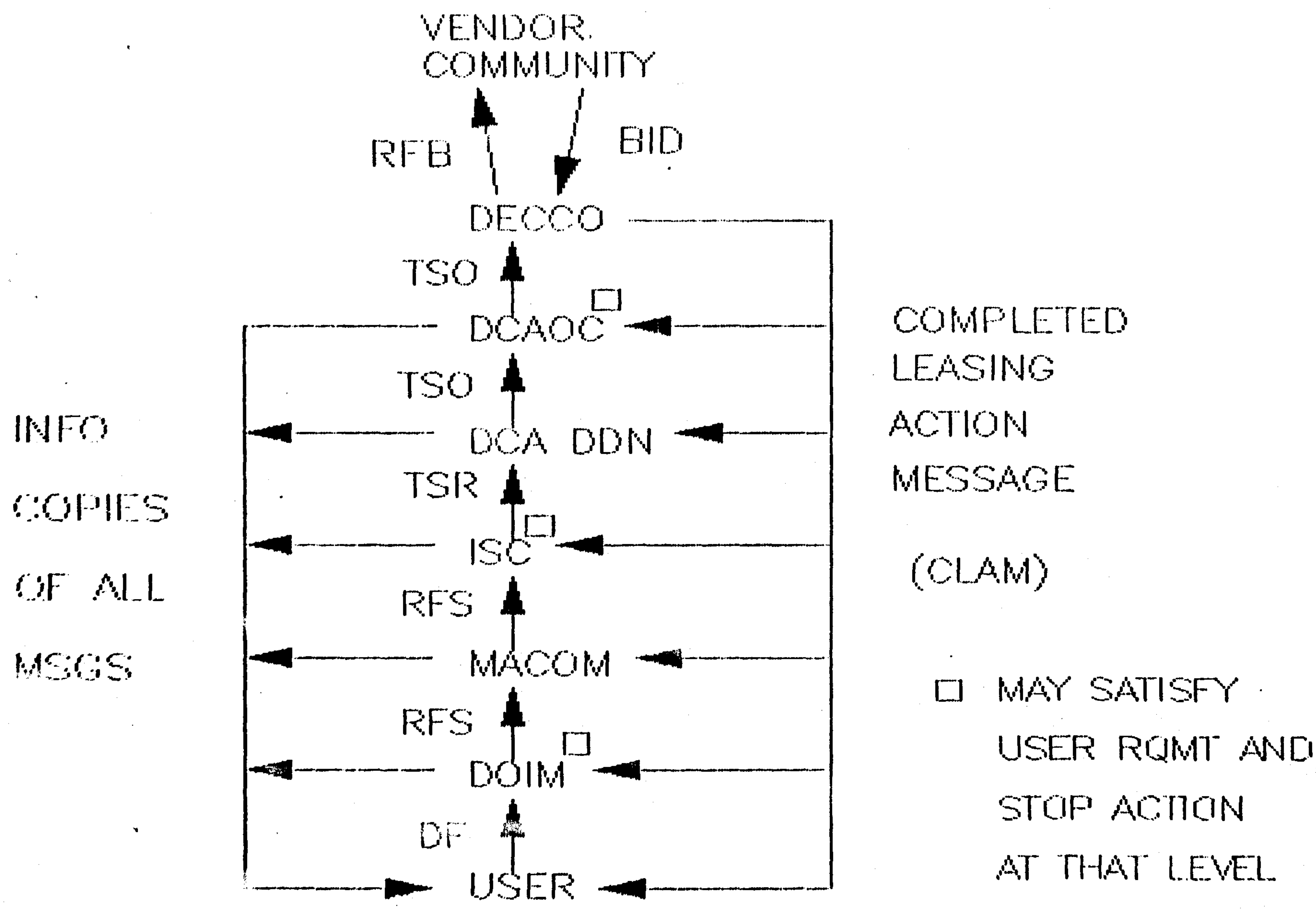
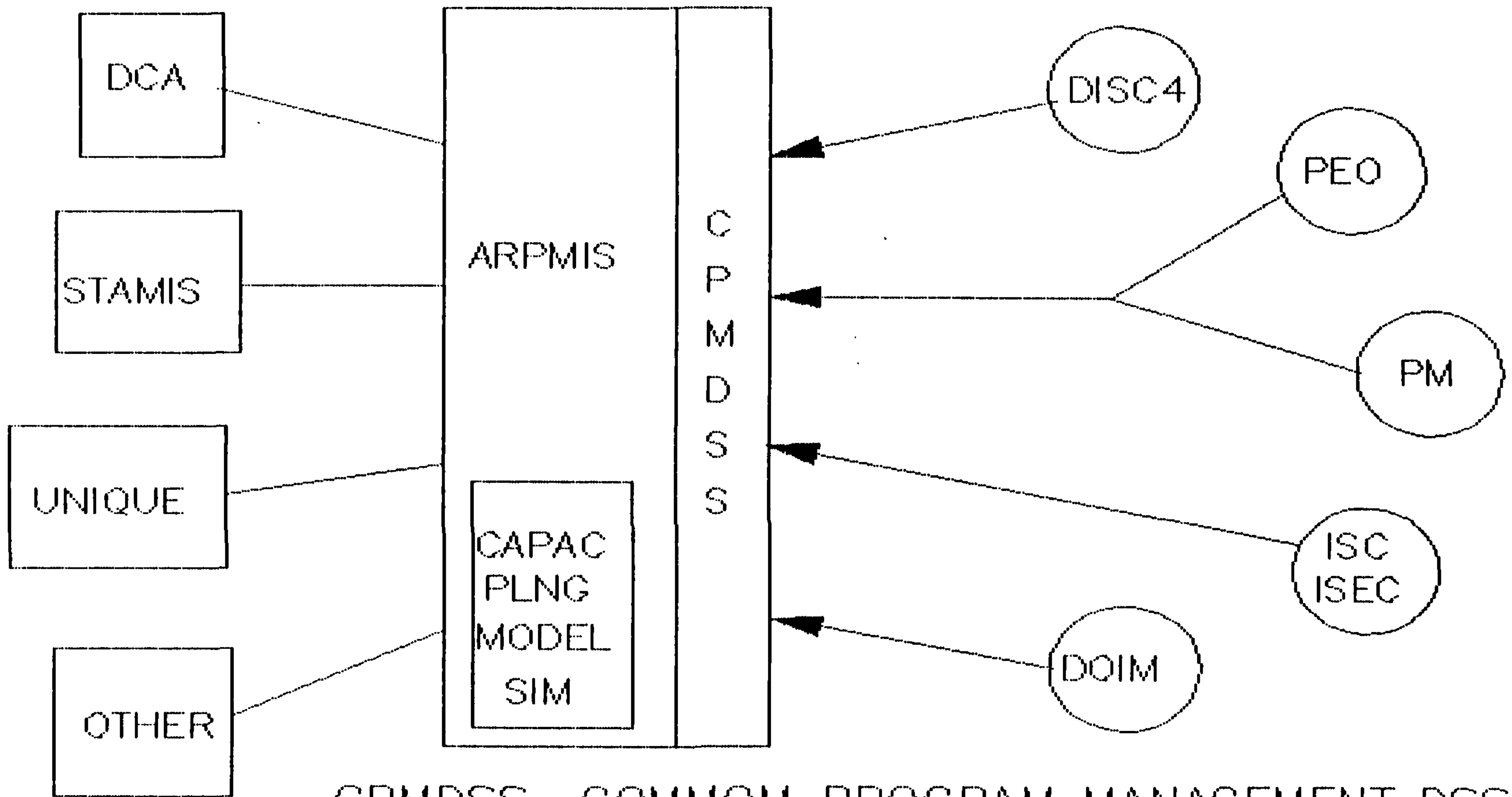

VENDOR.
COMMUNITY
RFB
BID
DECCO
TSO
DCAOC
TSO
DCA DDN
TSR
ISC
RFS
MACOM
RFS
DOIM
DF
USER
INFO
COPIES
OF ALL
MSGS
COMPLETED
LEASING
ACTION
MESSAGE
(CLAM)
MAY SATISFY
USER RQMT AND
STOP ACTION
AT THAT LEVEL

FIGURE 3.2



CPMDSS COMMOM PROGRAM MANAGEMENT DSS

FIGURE 3.3